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Beefing up storage on your network doesn't have to be a chore, thanks to a new breed of devices that offer quick setups and lots of space to store your files. In this edition of Focus, we explore the world of network-attached storage (NAS) and ways to evaluate these technologies and incorporate them into your computing environment.



● What is NAS?

You can never be too rich, be too thin, or have too much data storage on your network. Until recently, it wasn't easy to keep up with the demands of your users' storage needs. While hard disk prices continue to drop, reconfiguring the disk drives inside a network server isn't a simple operation. You have to find time when your servers aren't being used to take them apart and add the bigger drives, as well as to make backups and accomplish other time-consuming chores.

That is, thankfully, a thing of the past, now that a group of products called network-attached storage, or NAS, is on the scene. NAS devices can take the shape of anything from a device hardly bigger than a 4-port hub to units designed to fit into 19-inch racks and large cabinet systems.

There is another category of products called storage-area networks, or SANs. SANs and NAS are more complementary than competitive; they can work together to meet a wide variety of application needs. (See *Choosing the Right Application*, on page 2 and *SANs vs. NAS*, on page 4.)

The idea behind NAS is simple: a device, usually without any monitor, mouse, or keyboard, is connected to two things: electrical power and your network. A set of configuration screens, typically accessed through a Web browser, helps set you up with an IP address and user accounts. Within a few minutes, you have gigabytes or terabytes of additional storage capacity.

The nice thing about NAS units is their ability to mimic "real" Windows NT/2000, UNIX, or Macintosh servers. This means that your users don't have to do anything differently when they want to access them. As far as they are concerned, the NAS unit is just another server out on the network on which to save or from which to retrieve their important files.

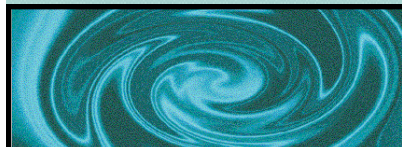
There are three basic kinds of NAS servers. (See chart on page TK.) First are the simple appliances that typically hold 20 to 80GB of data. These are mainly designed for small or remote offices or workgroups. These servers have minimal setup tools to reduce potential confusion, and are geared toward being shared by fewer than twelve people. These devices generally have one or two disk drives inside them and sell for less than \$1,000.

These simple appliances are geared just for network file storage: there are other products, such as the Cobalt Qube, that come packaged as turnkey Web and Internet servers. While NAS devices come with a built-in Web server, they use them mostly for managing their own configuration and operations.



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Next are devices geared more towards medium-sized workgroups or offices, to either replace existing network servers or to augment their storage capabilities. These devices have more sophisticated features, including backup software and redundant drives and power supplies, to keep reliability high. A good example here is the Snap Server 4100 series and the DiskZerver. Typical prices are less than \$10,000. These devices have multiple drives inside, sometimes a dozen or more.

Finally, there are more enterprise-level units, from EMC and Auspex. These units are usually available in 19-inch rack mounts or come with their disk drives packaged in refrigerator-sized cabinets. They also come with dozens of removable drives and terabytes of storage, available to supply hundreds of users with a variety of network interfaces beyond simple 10BaseT Ethernet. Typical of these kinds of products are the EMC CLARiiON IP4700 Series, which have several redundant power supplies for the disk drive array as well as multiple network attachments. Prices for units in this class start at more than \$10,000 and can easily top ten times that amount, depending on features.

For links to product information and additional Web resources, go to www.cdw.com/nas.

Choosing the Right Application

Which storage product is right for you? Well, it depends on your application requirements. Here is a quick guide.

—Server consolidation

If your file servers are scattered around your enterprise and difficult to track down, perhaps it is time to consider some kind of server consolidation. This means running fewer servers with more storage installed on each server. Consolidation will reduce management headaches and increase availability and reliability, as typically the replacement servers are more capable in these areas. Either NAS or SANs make sense for this task.

—Engineering applications

NAS devices are the most appropriate for high-demand engineering applications like computer-aided design and software development. These applications typically create and have to manage huge files, placing heavy demands on traditional file servers.

—High-availability applications

Concerns about application availability and reliability, such as for mission-critical decision-support systems and customer care systems, are increasing the need for more reliable storage systems on servers. Both NAS and SAN devices can help here, in terms of providing more than just a redundant array of disk drives and including integrated management tools and monitoring systems. These tools can alert you to any potential storage system failures and allow you to keep track of when you will need to add additional storage devices to accommodate your increasing data needs.

—Internet-related storage

If you are running Internet applications or staffing up an Internet data center, then NAS devices are a good match for you. Things such as Web services, Web caching, e-commerce storefronts, and Web/database applications will require systems that can be managed remotely via Web browsers and incorporate Web servers into their operations.

—UNIX/NT file sharing

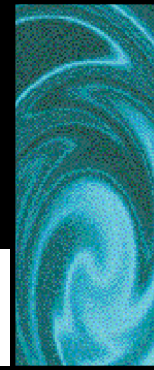
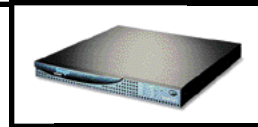
If you have both UNIX and Windows users on your network and you want both groups to be able to share files, NAS devices are most appropriate. Some of the products allow you to share files with Macintosh users as well.

● Features of NAS Appliances

Given that NAS servers come in all shapes and sizes, it isn't too surprising that these devices have a variety of features as well. Perhaps the first thing to determine is exactly how much disk space is available on the unit itself. Typically, each manufacturer offers a range of different capacities, and from this information you can generally get an idea of where the unit is intended to be used—20 to 30GB units are for smaller workgroups, while units in the terabyte range such as ADIC's StorNext are designed more for enterprise networks.

Most NAS devices come without a keyboard, a mouse, or any monitor ports (see *Does a Keyboard Matter?*, on page 7).

NAS devices can make use of existing directories of user accounts from Windows, NetWare, or UNIX servers, or can be set



authenticate users from their own user lists. Using existing directories makes sense if you have already set up your network access controls and

users and don't want to maintain two different sets of lists. Authenticating users from their own user lists is useful if the NAS will be the first network server on your network and you don't want to set up a separate NT or 2000 server just to maintain user accounts and authentications.

Most of the products come with auto-sensing 10/100Mbit Ethernet connections. This makes it easy to move them from one network to another—you won't have to worry about resetting your network connection type. Others come with plug-in adapters for higher-speed networks, including Gigabit Ethernet, ATM, and FDDI connections.

Some of the products, such as the Snap Server, include support for Macintosh and UNIX clients in addition to providing network files for Windows users. This means that if you have a mixed operating system environment, these users can share files with each other and thereby collaborate with their colleagues. Of course, if you do intend to use these devices in a mixed environment, you'll need to make sure that you have consistent software versions across all of your platforms, such as Microsoft Office 2000 (which can read and write files between Windows and Macintosh users, provided that the files are saved in the correct format). Here is a sample setup screen from the DiskZerver that shows all the various protocols available:





Other products, such as the Linksys Instant GigaDrive, include a parallel printer port on the back of each unit. Having a printer connection makes sharing printers across a workgroup very simple, since a separate network printer/server device is no longer required. Some products, such as HP's SureStore HD Server 4006, come with an external SCSI connector, so you can attach extra external hard disks to the unit without having to take it apart or even to turn it off.



Speaking of taking these NAS devices apart, some are designed for easy access, such as the Snap Server 4100: turning two thumb screws on the cover is all that is needed to open the unit up, and the disk drives are readily accessible if they need to be serviced or upgraded with larger capacity units.



Many of the devices, including Intel's InBusiness Storage Station and the Snap

Server, allow you to configure the disk storage to your own particular needs, either as a single large volume or as mirrored or RAID 5 redundant volumes, for extra protection and reliable operation. While you reduce your overall storage by half by using mirroring, you also significantly decrease your risk of a hard disk failure and subsequent data loss. When you set up the unit, you specify the type of storage configuration you want to use through any ordinary Web browser (see *Setting up Your Storage Tour*, below). You should be fairly certain of this before you begin to use the unit to store files: if you decide later on to change the configuration, you will have to reformat the disks—which will cause you to lose your data.

Speaking of redundancy, HP's SureStore HD Server 4000 unit comes with a built-in DAT tape drive, making it easier to back up your data. With other NAS servers that don't have built-in tape units, you'll have to incorporate backups into your regular routines and make copies of files over the network to your backup servers. This can take a while, particularly if you have tens of gigabytes of data to copy.

Some products come with a second power supply, something normally only found on higher-end servers. Again, this is something to consider if you are concerned about reliable operations.

Finally, there are some units that come with hot-swappable removable drives, such as the HP SureStore and EMC CLARiiON IP4700. Again, this makes it easier to upgrade or service the unit, since you don't have to turn off the device to replace the drives.



● Setting up your storage tour

The Snap Server is aptly named: getting it set up will take just a few minutes using your Web browser. The quick configuration series of menus takes you step-by-step through the process. Let's see how it is done.

First, you set up the current date and time for the server's clock:



Then, you select which networking environment you want the server to operate in. Snap Server is one of the more versatile NAS devices in that it supports AppleShare, UNIX NFS, and Novell Netware networks, in addition to standard Windows protocols.



Once you are done, you will see a summary of all your network settings, similar to the one shown in the screen below:



Finally, you select whether you want to use your existing user accounts on a Windows server or set up new accounts. And you choose the kind of disk drive configuration you would like. You can see the following

screen to show exactly what kind and capacity of disk drives are installed on the device below:



You then reboot the server for these changes to take place. Once the server is operating, you can view error logs and any other warnings in your browser; for example, you may see a message similar to the one in the screen below:



Storage technologies benefits comparison chart

BENEFIT	SERVER ATTACHED STORAGE	NAS	SAN
Reduced storage management costs through server consolidation	No	Yes	Yes
Scalable storage	No	Yes	Yes
Storage units separate from servers	No	Yes	Yes
Single image of storage available to users of different operating systems	No	Yes	Yes
Network bottlenecks avoided	Yes	No	No
Single server bottlenecks avoided	No	Yes	Yes
Server-independent backups	No	Yes	Yes
Centralized storage management and support	No	Yes	Yes
Reliability improvements	No	Yes	Yes

Storage Characteristics Comparison Chart

STORAGE CHARACTERISTICS	SERVER ATTACHED STORAGE	NAS	SAN
Storage emphasis	Server-centric	Network-centric	Channel-centric
Data security	Depends on server	Depends on network	Depends on server, switch, or storage
Installation	Easy to set up, harder to upgrade	Easy to set up and upgrade	Difficult
Management	Server-based	Web-based	Varies
Multi-client access	No	Yes	Yes
Disaster recovery	Custom solutions	Emerging standards	Proprietary solutions
Offloads application server workload	No	Yes	No
Mirroring/redundant disks	Varies	Yes	Varies

● **NAS Segmentation**

	ENTRY LEVEL	WORKGROUP/MIDRANGE	HIGH END/ENTERPRISE
Number of clients	1-12	20-200	100s or 1,000s
Usage	Small office or workgroup	Mid-sized office or workgroup	Data center or enterprise
Storage	1-2 IDE drives; JBOD or limited RAID	Up to 15 IDE or SCSI drives; JBOD or up to RAID 5	100s of SCSI or FC drives; multiple/redundant controllers; all RAID levels
Interfaces	10/100Mbit Ethernet	100Mbit or Gigabit Ethernet	100Mbit or Gigabit Ethernet, ATM, FDDI
Manufacturers	3Com Castelle Cobalt Intel Linksys Maxtor NETGEAR Seagate Snap Appliances Quantum	Addonics ADIC Axis Axonix Compaq Connex Excel/Meridian Data HP IBM Maxtor Microtest Network Appliance Network Engines nStor Procom Quantum ATL Snap Appliances Quantum	ADIC Auspex EMC Network Appliance
Typical street prices	\$500-\$1,999	\$2,000-\$9,999	\$10,000-\$500,000

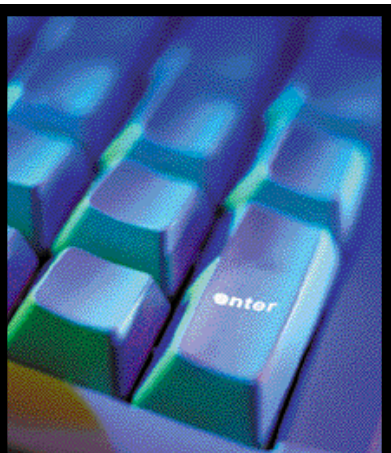
	SAS—SERVER-ATTACHED STORAGE	NAS—NETWORK-ATTACHED STORAGE	SAN—STORAGE-AREA NETWORK
Products	<ul style="list-style-type: none"> • Hard drives • Tape drives • Tape automation units • Storage arrays • CD-ROMs • DVDs • Floppy drives • Interface controllers • RAID controllers 	<ul style="list-style-type: none"> • NAS servers • NAS engines 	<ul style="list-style-type: none"> • Tape drives • Tape automation units • Storage arrays • NAS servers • FC hubs and switches • Host bust adapters • Interface controllers • RAID controllers • ridges • Cabling • Software
Connection	Direct	Network	Direct/network
Internal interface(s)	<ul style="list-style-type: none"> • IDE/ATAPI • SCSI • Fibre Channel 	N/A	N/A
External interface(s)		<ul style="list-style-type: none"> • 10/100/1000Mb (i.e., Gigabit Ethernet) • ATM • FDDI 	<ul style="list-style-type: none"> • SCSI (over IP) • Fibre Channel

● Does a keyboard matter?

Typically, NAS devices don't come with a keyboard, a mouse, or any monitor ports: you need to set them up over the network, either by using some supplied Windows setup utility software, or by using your Web browser and connecting to the built-in Web server inside each NAS and filling out the appropriate browser-based setup forms. One exception to this is the NASengine 1U, which comes with ports for attaching keyboards and monitors. While this can be useful for debugging purposes, these extra ports aren't needed beyond an initial configuration. Another solution is to use Network Engines' AdminEngine, which is a management appliance that can operate remote consoles on other Network Engine server appliances.

The absence of the keyboard and monitor increases security, since a user can't just walk up to these servers and make changes to the system configuration—something that can be done with an ordinary NT or Windows 2000 server that sits in a public office area, for example.

Speaking of security, any NAS device creates potential security issues for any corporation. Because most anyone can set up and remove a NAS device, it wouldn't be difficult for a rogue employee to copy large amounts of data from a corporation and then take it home with him. And because they mimic standard Windows and UNIX file servers, it may be difficult to track their use in the many corporations which have numerous file servers centrally managed by an IT department. All this means is that corporations should be



careful in how they set up network access for their employees and in how they keep track of shared network resources. It is also a good idea to keep any critical NAS inside a locked closet or server room to keep this data from leaving the premises.

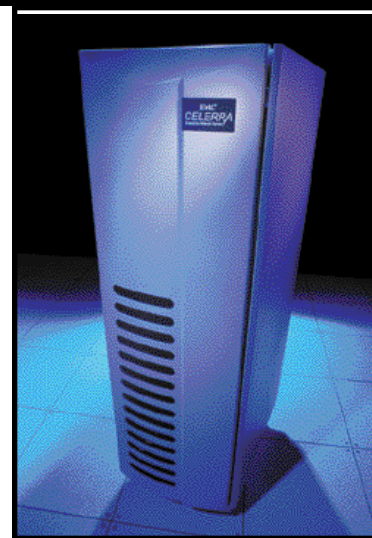
● Now we are talking price

Given that hard disks are continually coming down in price, does it make sense to buy a NAS device? Well, not if you just look at the per-gigabyte cost for the storage. For example, CDW sells several 20GB IDE drives for less than \$200, making the cost per gigabyte around \$10. All of the NAS devices cost at least twice that per gigabyte, and some cost even more.

But the cost per byte isn't the only expense in setting up a network-storage server. Consider what all of the costs are when you run out of room on your NT/2000 server and need to replace it with one of those newer, higher-capacity disk drives. First, you have to backup all your data, along with your network configuration. Then you have to take down the server, disconnecting your users while you work on the unit. Finally, you have to open up the PC and remove the existing hard disk, replace it with the new disk, reinstall NT or Windows 2000, and restore the configuration. That could take hours if you know what you are doing, and days if you don't. Meanwhile, your users don't have access to their files. So spending a few extra dollars per byte can save you the time and aggravation that comes with trying to reconfigure your own equipment.



The cost for a NAS device also makes sense when these servers are going into places with minimal network support, or in new networks in remote branch offices. This makes supporting such networks easier, since you don't have to have an experienced UNIX or NT network administrator standing by to do troubleshooting, or have to walk someone through a network restart over the phone. You could easily save the cost of one support call by buying one of these devices.



● The Tape Story: LANVault and StorNext

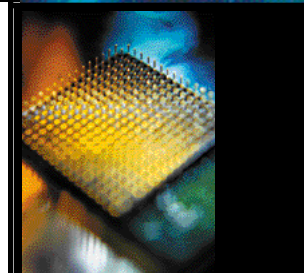
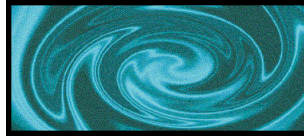
Quantum | ATL and ADIC both make specialized NAS devices, respectively called the LANVault and the StorNext. Both of these are NAS appliances for tape automation. They are useful for doing large-scale backups, necessary when your storage needs grow beyond what can fit comfortably on a single tape cartridge. They are also useful as near-line storage devices. Quantum | ATL and ADIC have done the hard work of integrating the various pieces together in a single unit—a series of tape drives with a robotic autoloader, a network-attached server, backup software, and a Web-browser interface to run the whole show. Having a browser interface is critical here, because it reduces the time required to administer the package. And, a single network administrator can remotely manage backup software, the operating system, and firmware of all appliances across the enterprise as well.

Using tapes, these NAS servers have a tremendous range in storage capacity, and can easily scale up as your storage requirements grow. StorNext, for example, can handle between 1 and 23.6 terabytes of data. It comes with a large hard disk cache to store frequently requested files, and can deliver any file within a minute of its request by a user.



Network Attached Storage explained!

- How to pick the right technology
- Understanding the differences between server-attached storage, NAS, and SANs
- How to quickly add gigabytes of storage to your network



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